Core course 10 Code: BO6CRT10

CELL AND MOLECULAR BIOLOGY

(Theory 54 hrs; Practical 36 hrs; Credits 3 + 1)

Objectives:

- Understand the ultra structure and functioning of cell in the sub-microscopic and molecular level.
- Get an idea of origin, concept of continuity and complexity of life activities.
- Familiarization of life processes.
- Understand the basic and scientific aspect of diversity.
- Understand the cytological aspects of growth and development.
- Understand DNA as the basis of heredity and variation.

CELL BIOLOGY (Theory 27 hrs; Practical 27 hrs)

Module1: Ultra structure of cell components (8 hrs)

Cell biology through ages: a brief history of cell biology. Cytosol - chemical composition. Composition, structure and function of plasma membrane - fluid mosaic model.

The ultra-structure of a plant cell with structure and function of the following organelles: Endoplasmic reticulum, chloroplasts, Mitochondria, Ribosomes, Dictyosomes, Microbodies - peroxisomes and glyoxisomes, lysosomes and vacuole. Cytoskeleton - microtubules and microfilaments.

Ultra structure of nucleus: nuclear envelope - detailed structure of pore complex, nucleoplasm - composition, nucleolus.

Module 2: Chromosomes (6 hrs)

Chromosomes: introduction, chromosome number, autosomes and allosomes, morphology - metacentric, submetacentric, acrocentric and telocentric. Structure - chromatid, chromonema, chromomere, centromere and kinetochore, telomere, secondary constriction and nucleolar organizer. Chromatin fibres: heterochromatin and euchromatin. Karyotype and ideogram.

Chemical composition of chromatin: histones and non-histones, arrangement of proteins and DNA in chromatin - the 10 nm fibre (nucleosome model), 30 nm fibre (solenoid model) and central axis with radial loops of 300 nm fibre.

Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).

Module 3: Cell division (6 hrs)

Cell cycle - definition, different stages – interphase (G1, S and G2) and division phase. Mitosis: karyokinesis and cytokinesis, significance of mitosis. Meiosis: stages - first meiotic division (reduction division) and second meiotic (equational division), structure and function of synaptonemal complex, significance of meiosis; comparison of mitosis and meiosis.

Module 4: Chromosomal aberrations (4 hrs)

Numerical: heteroploidy; euploidy – haploidy; polyploidy – autopolyploidy, allopolyploidy (*Raphanobrassica*); aneuploidy - monosomy, trisomy (Fruit morphology in Datura), nullisomy (*Triticum*). Numerical chromosomal abnormalities in man: Down‘s syndrome, Klinefelter‘s syndrome, Turner‘s syndrome.

Structural: deletion (Cri-du-chat syndrome), duplication (Bar eye in Drosophila), inversions (paracentric and pericentric) and Translocations (Robertsonian translocation).

Module 5: Mutation (3 hrs)

Mutation: definition, importance. Types of mutations: somatic and germinal; spontaneous and

induced; chromosomal and gene or point mutations. Molecular basis of mutation: frame shift, transition, transversion and substitution. Mechanism of mutation induction: base replacement, base alteration, base damage, errors in DNA replication. Mutagens: physical - non-ionizing and ionizing radiations; chemical - base analogs, alkylating agents, deaminating agents.

PRACTICAL (27 hrs)

1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.
2. Study the mitotic index of onion root tip cells (Demonstration only).
3. Study of the different stages of meiosis and identification of different substages of prophase I using photomicrographs or pictures.
4. Identify and study the chromosomal anomalies, patterns and karyotype in man such as Down's syndrome, Turner's syndrome and Klinefelter's syndrome.

MOLECULAR BIOLOGY (Theory 27 hrs; Practical 9 hrs)

Module 6: The genetic material (8 hrs)

Molecular biology: a brief historical prelude. Identification of DNA as genetic material: direct evidences – transformation experiment by Avery *et al*.; Hershey and Chase Experiment. Evidences for RNA as genetic material in some viruses.

Nucleic acids: DNA and RNA, important features of Watson and Crick model of DNA; Chargaff's rule. Alternate forms of DNA - comparison of A, B and Z forms. Structure and function of different types of RNA - tRNA, mRNA, rRNA, snRNA, miRNA.

Module 7: Replication of DNA (4 hrs)

Semiconservative replication of DNA - Messlson and Stahl's experiment; process of semiconservative replication with reference to the enzymes involved in each step.

Module 8: Gene expression (8 hrs)

Gene expression: concept of gene, split genes, one gene one enzyme hypothesis, one gene one polypeptide hypothesis, the central dogma, reverse transcription. Details of transcription in prokaryotes and eukaryotes; hnRNA, splicing, release of mRNA. Translation - initiation, elongation and termination. Genetic code and its features, wobble hypothesis.

Module 9: Regulation of gene expression (5 hrs)

Regulation of gene expression in prokaryotes: operon concept, indicible and repressible systems, negative control and positive control. Lac operon, catabolic repression. Tryptophan operon, attenuation. Regulation in eucaryotes (brief account only).

Module 10: Genetics of cancer (2 hrs)

Genetic basis of cancer – brief description of proto-oncogenes and oncogenes, tumour suppressor genes; characteristics of cancer cells.

PRACTICAL (9 hrs)

6. Work out elementary problems based on DNA structure, replication, transcription and translation and genetic code.

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Core course 11 Code: BO6CRT11
ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY
(Theory 72 hrs; Practical 45 hrs; Credits 3 + 1)

Objectives:

- Acquaint with the aims, objectives and significance of taxonomy.
- Identify the common species of plants growing in Kerala and their systematic position.
- Develop inductive and deductive reasoning ability.
- Acquaint with the basic technique in the preparation of herbarium.
- Familiarizing with the plants having immense economic importance.

ANGIOSPERM MORPHOLOGY

Module 1: Leaf, Inflorescence and Fruit morphology (13 hrs)

Leaf Morphology: types, venation, phyllotaxy. Morphology of flower: flower as modified shoot; detailed structure of flowers - floral parts - their arrangement, relative position - symmetry, aestivation and placentation types - cohesion and adhesion. Floral diagram and floral formula. Inflorescence: racemose types - simple raceme, corymb, umbel, spike, spadix, head and catkin; cymose types - simple cyme; monochasial - scorpoid and helicoid, dichasial and polychasial; special type - cyathium, hypanthodium, verticillaster, thyrsus and panicle. Fruits: simple - fleshy, dry - dehiscent, schizocarpic, indehiscent, aggregate, multiple (sorosis and syconus).

TAXONOMY

Module 2: Principles of Plant systematics (12 hrs)

Aim, scope, significance and components of taxonomy. Types of classification - artificial (brief account), natural – Bentham and Hooker (Detailed account) and Phylogenetic (Brief account). Angiosperm phylogeny group system (introduction only). Plant nomenclature - binomial, ICBN/ICN principles - rule of priority and author citation. Interdiciplinary approach in taxonomy -